Navajo County Department of Public Works

ADOT Hydrology Manual Guidelines: Estimating Percent Vegetative Cover

The Navajo County Department of Public Works has developed these guidelines for estimating average vegetative cover density for use in the ADOT Hydrology Manual HEC-1 methodology. The following guidelines are recommended for use in Navajo County.

General Information

Vegetative cover density is defined as the percentage of land surface within a watershed, or sub-basin, that is covered by vegetation. For grasses, vegetative cover is evaluated using the basal area of the plants. For trees and shrubs, vegetative cover is evaluated using the canopy cover. Vegetative cover, whether by tree canopy or grass, generally increases the infiltration rate of a soil compared to its infiltration rate on bare ground. Therefore, the ADOT Manual HEC-1 methodology includes an adjustment factor for the hydraulic conductivity (XKSAT) component of infiltration based on the estimated average vegetative cover density.

The Green-Ampt parameter spreadsheet distributed by the Navajo County Department of Public Works automatically adjusts the XKSAT parameter when the average vegetative cover density is entered. This document provides guidelines to help estimate vegetative cover density.

Sources of Data

Vegetative cover density varies widely throughout Navajo County in response to differing annual precipitation depths, average temperature, soil characteristics, elevation, land management, and numerous other factors. Therefore, average percent vegetative cover usually must be estimated using site specific data and engineering judgment. The following methodologies and sources of vegetative cover data are recommended for use in Navajo County:

- ***Field Survey***. Vegetative cover data may be obtained by detailed inspection of the project watershed. The following should be considered during a field survey to obtain vegetative cover density estimates:
    - Field visits should be made to each sub-basin and each land use type.

  * Photographs from the project watershed should be provided to document vegetative cover density values used.
  * Transects should be performed to document the percent vegetative cover estimate for each representative cover types.
  * Care should be exercised to consider the potential for seasonal variation of canopy and grass cover, as well as for possible variation in land management practices (e.g., grazing).

- ***Published Reports***. Average vegetative cover density estimates are provided in several types of reports for the Navajo County area. These include the following:

  * NRCS Detailed Soil Surveys. Detailed soil surveys prepared by the NRCS include a description of the type of vegetation supported by each soil unit and the general condition of the vegetation (poor, fair, or good), which correspond to the values shown in Table 1.
  * USFS Terrestrial Ecosystem Report. The US Forest Service publishes soil survey and vegetative community data for lands within the National Forest System.
  * USGS Gauge Summaries. Vegetative cover density estimates for gauged watersheds are published in Garrett & Gellenbeck (1991).

- ***Aerial Photographs***. Aerial photographs of the watershed are most useful for identifying the general types of vegetation present in the watershed. Because small patches of bare ground in vegetated areas are difficult to identify on most high altitude aerial photographs, estimates of percent vegetative cover made from aerial photographs tend to be too high. The following guidelines apply to use of aerial photographs:

  * Photographs used to estimate vegetative cover should have been taken at low altitude, whenever possible.
  * Photographs of the watershed should be recent and should reflect the land use conditions observed in the field.
  * Vegetative cover estimates made from the aerial photographs should be field verified, with ground photographs provided for documentation.

- ***Agency Personnel***. Range management maps, vegetative community and species distribution maps may be available for some public lands. Agency specialists may have documentation of vegetation studies that provide cover density information. Agencies with range management, forestry, or engineering specialists include the following:

* Bureau of Land Management (BLM)
* United States Forest Service (USFS)
* Natural Resource Conservation Service (NRCS)
* Bureau of Indian Affairs (BIA)
* National Park Service (NPS)
* Navajo Nation
* Hopi Nation
* Arizona State Land Department (ASLD)

Guidelines

Average percent vegetative cover values are shown in Table 1. These values are intended to supplement, not replace, site specific field data and sound engineering judgment, and are based on information provided in the references cited below.

Table 1. Navajo County Dept. of Public Works
Recommended Vegetative Cover Density Values

Vegetative Cover Type	Percent Cover Value		
	Poor	Fair	Good
Desert Species	10	30	40
Non-Desert Species	40	55	75

Notes:
1. If the recommended values given in this Table are not used, documentation justifying the use of alternative values must be provided with the hydrologic modeling. Documentation must include technical references that support use of the alternative values, as well as copies of computation sheets for all calculations.
2. Ratings of good, fair, and poor provided in most NRCS detailed soil survey reports.
3. Values based on ADOT, 1969; PCFCD, 1979; & USDA, 1983.

Use of the average percent vegetative cover values shown in Table 1 are subject to the following considerations.

1. Grazing. Areas subject to cattle grazing should never be rated higher than "Fair" for estimating percent vegetative cover.

2. Grazing & Burns. Areas that have experienced recent forest fires and that are grazed should be rated as "Poor."

3. Maximum Cover Density. Several references indicate that cover density does not exceed 80% for non-desert species, and 50% for desert species. Use of percent cover estimates exceeding these recommended values should be thoroughly documented using field procedures described below.

Field Transect Procedures

Where vegetative cover is estimated in the field, the following procedure is recommended:

Step 1: A area representing the typical vegetative cover density for the watershed, sub-basin, or land use type is selected.

Step 2: A 100-foot tape is stretched out between two posts, approximately three feet above ground level.

Step 3: The intercepts of the vegetative cover (i.e., cover or bare ground) along the 100 foot tape at 5-foot intervals are recorded.

Step 4. The total distance covered by vegetation along the 100-foot tape are summed and divided by 100 to compute the percent of vegetative cover.

Step 5: Several test transects should be made to compute the average percent of cover for the area.

Figure 1 illustrates the field transect procedure described above.

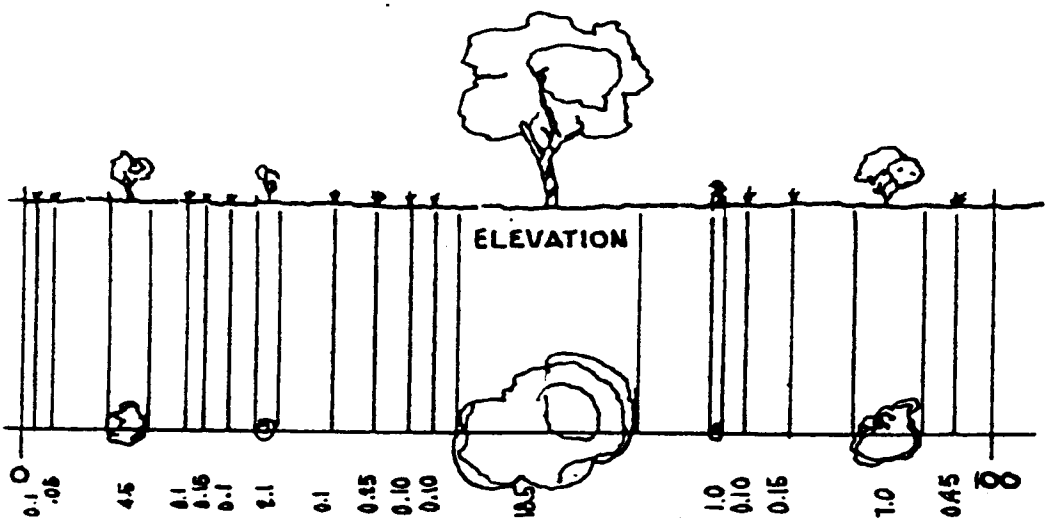

Figure 1. Illustration of Field Procedure for Estimating Vegetative Cover.

Technical References: Estimating Average Percent Vegetative Cover

ADOT, 1969, *Hydrologic Design for Highway Drainage in Arizona*. Report by E. I. Jencsok/ Arizona Highway Department - Bridge Division. March 1969.

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Technical References: Relationship of Vegetative Cover Density to XKSAT

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